

## VARIABLE WIDTH PCIE INTERFACE

### BACKGROUND

**[0001]** Field of the Invention

**[0002]** This invention relates to systems and methods for interfacing a motherboard with one or more expansion cards, such as PCIe expansion cards.

**[0003]** Background of the Invention

**[0004]** Since the early days of computers, the basic system architecture has included a motherboard and one or more expansion slots. The motherboard includes the computer's most basic circuitry and components. For example, a motherboard typically included a central processing unit, memory (e.g. RAM), a basic input/output system (BIOS), the expansion slots, and interconnecting circuitry.

**[0005]** Expansion cards were originally used for many functions, such as audio processing, video processing, networking, and the like. Although many of these functions have been incorporated into the motherboard, expansion slots are still used for critical functions. In particular, routers, switches, and other high-performance networking components are often incorporated into expansion slots in rack-mounted servers.

**[0006]** The systems and methods described herein provide an improved approach for implementing expansion slots in a rack-mounted server or other applications.

### BRIEF DESCRIPTION OF THE DRAWINGS

**[0007]** In order that the advantages of the invention will be readily understood, a more particular description of the invention briefly described above will be rendered by reference to specific embodiments illustrated in the appended drawings. Understanding that these drawings depict only typical embodiments of the invention and are not therefore to be considered limiting of its scope, the invention will be described and explained with additional specificity and detail through use of the accompanying drawings, in which:

**[0008]** FIG. 1 is an isometric view of a chassis implementing a mid plane and mother board slot in accordance with an embodiment of the present invention;

**[0009]** FIG. 2 is an isometric view of the chassis having a top plate attached;

**[0010]** FIG. 3 is an isometric view illustrating insertion of a motherboard into the chassis in accordance with an embodiment of the present invention;

**[0011]** FIG. 4 is a lower isometric view illustrating insertion of the motherboard into the chassis in accordance with an embodiment of the present invention;

**[0012]** FIG. 5 is a lower isometric view illustrating insertion of the motherboard inserted into the chassis in accordance with an embodiment of the present invention;

**[0013]** FIG. 6 is an isometric view illustrating the motherboard inserted into the chassis in accordance with an embodiment of the present invention;

**[0014]** FIG. 7 is a front view of a PCIe socket in accordance with the prior art;

**[0015]** FIG. 8 is a front view of an arrangement of PCIe socket in accordance with an embodiment of the present invention;

**[0016]** FIG. 9 is an isometric view illustrating the chassis having an expansion card occupying four PCIe sockets in accordance with an embodiment of the present invention;

**[0017]** FIG. 10 is an isometric view illustrating the chassis having two expansion cards each occupying two PCIe sockets in accordance with an embodiment of the present invention;

**[0018]** FIG. 11 is an isometric view illustrating the chassis having four expansion cards each occupying one PCIe socket in accordance with an embodiment of the present invention;

**[0019]** FIG. 12 is a schematic block diagram of a system implementing variable width expansion card connections in accordance with an embodiment of the present invention; and

**[0020]** FIG. 13 is a schematic block diagram of components of a motherboard in accordance with the prior art.

### DETAILED DESCRIPTION

**[0021]** It will be readily understood that the components of the present invention, as generally described and illustrated in the Figures herein, could be arranged and designed in a wide variety of different configurations. Thus, the following more detailed description of the embodiments of the invention, as represented in the Figures, is not intended to limit the scope of the invention, as claimed, but is merely representative of certain examples of presently contemplated embodiments in accordance with the invention. The presently described embodiments will be best understood by reference to the drawings, wherein like parts are designated by like numerals throughout.

**[0022]** Referring to FIG. 1, a chassis 10 may be sized to insert within a slot in a rack-mounted server and may define a securement interface known in the art for facilitating mounting. The chassis 10 may be understood with respect to a vertical direction 12, horizontal direction 14, and a longitudinal direction 16 that are mutually perpendicular. The vertical direction 12 corresponds to the direction of gravity. The horizontal direction 14 is perpendicular to the vertical direction and is parallel to a support surface on which the chassis 10 rests. A row of chassis 10 may be arranged along the horizontal direction 14 in rack. The longitudinal direction 16 is perpendicular to the vertical and horizontal directions 12, 14. Although various features are described herein with references to the vertical, horizontal, and longitudinal directions 12, 14, 16, these merely indicate relative position and orientation of components to one another. The chassis 10 may be placed in any orientation during use such that the vertical, horizontal, and longitudinal directions 12, 14, 16 may not correspond to absolute vertical, horizontal, or longitudinal directions, respectively, in some applications. For purposes of this disclosure a front of the chassis 10 is defined as the side into which expansion cards are inserted.

**[0023]** The chassis 10 includes a left plate 18 that is generally square or rectangular. A midplane 20 extends across the left plate 18 along the vertical direction 12 and may fasten directly to the left plate 18. The mid plane may span substantially the entire left plate 18 in the vertical direction 12, i.e. 80, 90, or 100 percent of the extent of the left plate 18 in the vertical direction 12.

**[0024]** A plurality of expansion sockets 22a-22d are mounted to the midplane 20. In the illustrated embodiment, the expansion sockets 22a-22d are PCIe sockets, however other socket types may be used. Likewise, although there are four expansion sockets 22a-22d in the illustrated implemen-